IN THE CLAIMS:

1. An apparatus operable with a gamma camera to detect position and energy information without pile-up, comprising:

first, second and third delay circuits configured to receive first, second, and third incoming signals from the gamma camera and to output the signals after first, second, and third time delays;

a trigger and timing circuit configured to receive the third incoming signal to detect an event and measure the time difference between two continuous events;

first, second and third computation circuits configured to receive the signals and to determine a weighted value for each of the signals; and

a digital signal processor connected to receive the weighted values and to subtract residual signal values corresponding to residual weighted values of previous ones of said first, second, and third incoming signals;

wherein the digital signal processor provides an output signal corresponding to a position value of the first and second incoming signals and an energy value of the third incoming signal.

2. The apparatus of claim 1, wherein at least one of the weighted values comprises a weighted-sum signal of an integrated signal and an instantaneous signal amplified by a time constant, τ.

3. The apparatus of claim 2, further comprising a low-pass filter configured to reduce noise from the weighted-sum signal.

4. The apparatus of claim 3, further comprising a digital filter configured to further reduce noise from the weighted-sum signal.

5. The apparatus of claim 1, further comprising a delay line for performing high resolution time measurement.

6. The apparatus of claim 1, wherein at least one of the computation circuits is configured to continuously sample the instantaneous signal and accumulate the samples in digital form.

7. The apparatus of claim 1, wherein at least one of the weighted values comprises a weighted integrated value.

8. A method for obtaining energy information for a plurality of incoming signals received from a detector, without signal pile-up, comprising:

delaying an incoming signal for a preselected time;

detecting an event and measuring the time difference between two continuous events using a trigger and timing circuit;

computing a weighted value of the incoming signal after the preselected time; and

subtracting a residual signal value from the weighted value to obtain the position and energy information , the residual signal value corresponding to a residual weighted value of at least one previous incoming signal, thereby preventing signal pile-up.

9. The method of claim 8, the weighted value comprises a weighted-sum signal of an integrated signal and an instantaneous signal amplified by a time constant, τ.

10. The method of claim 9, further comprising reducing noise from the weighted-sum signal using a low-pass filter.

11. The method of claim 10, further comprising further reducing noise from the weighted-sum signal using a digital filter.

12. The method of claim 8, wherein measuring the time difference comprises using a delay line for performing high resolution time measurement.

13. The method of claim 9, wherein the computing a weighted value comprises continuously sampling the instantaneous signal and accumulating the samples in digital form.

14. The method of claim 8, wherein the weighted value comprises a weighted integrated value.

15. A method of determining position and energy information of a plurality of incoming signals from a multi-zone position sensitive detector without pile-up, the method comprising:

receiving a first and second prenormalized position signal and a total energy signal from the detector;

comparing the prenormalized position signals with a prenormalized position threshold for a particular zone of the detector;

comparing the total energy signal with an energy threshold for the particular zone;

rejecting an event if the prenormalized position signals and the total energy signal fail the prenormalized threshold and the energy threshold ;

delaying said first and second prenormalized position signals and said total energy signal for a preselected time;

detecting an event and measuring the time difference between two continuous events using a trigger and timing circuit;

computing a weighted value for each of said first and second prenormalized position signals and said total energy signal after said preselected time;

sampling said weighted value for each of said first and second prenormalized position signals and said total energy signal upon receipt of a subsequent

one of said first and second prenormalized position signals and said total energy signal; and

subtracting a remnant position signal from each of said first and second prenormalized position signals.

16. A coincidence detection apparatus operable to detect position and energy information without pile-up, comprising:

first, second and third delay circuits configured to receive first, second, and third incoming signals from a position sensitive detector and to output the signals after first, second, and third time delays;

a trigger circuit configured to receive the third incoming signal and to generate a triggering signal upon receipt of a next third incoming signal;

first, second and third computation circuits configured to receive the incoming signals from the delay circuits and to determine a weighted value for each of the incoming signals;

first, second and third sampling circuits configured to receive the weighted values and to pass the weighted value upon receipt of the triggering signal; and

a digital signal processor connected to receive the weighted values and to subtract residual signal values corresponding to residual weighted values of previous ones of said first, second, and third incoming signals to form output data corresponding to a position value of the first and second incoming signals and an energy value of the third incoming signal; and

a FIFO memory configured to store the output data and to readout the output data after a variable delay period.

17. A method for obtaining position and energy information for a plurality of incoming signals received from a detector, without signal pile-up without pile-up, the method comprising:

delaying an incoming signal for a preselected time;

detecting an event and measuring the time difference between two continuous events using a trigger and timing circuit;

computing a weighted value of the incoming signal after the preselected time;

subtracting a residual signal value from the weighted value to obtain position and energy information , the residual signal value corresponding to a residual weighted value of at least one previous incoming signal, thereby preventing signal pile-up;

storing the position and energy information in a FIFO memory; and

outputting the position and energy information from the FIFO memory after a variable delay period.